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412.487 COMPLETE SPECIFICATION

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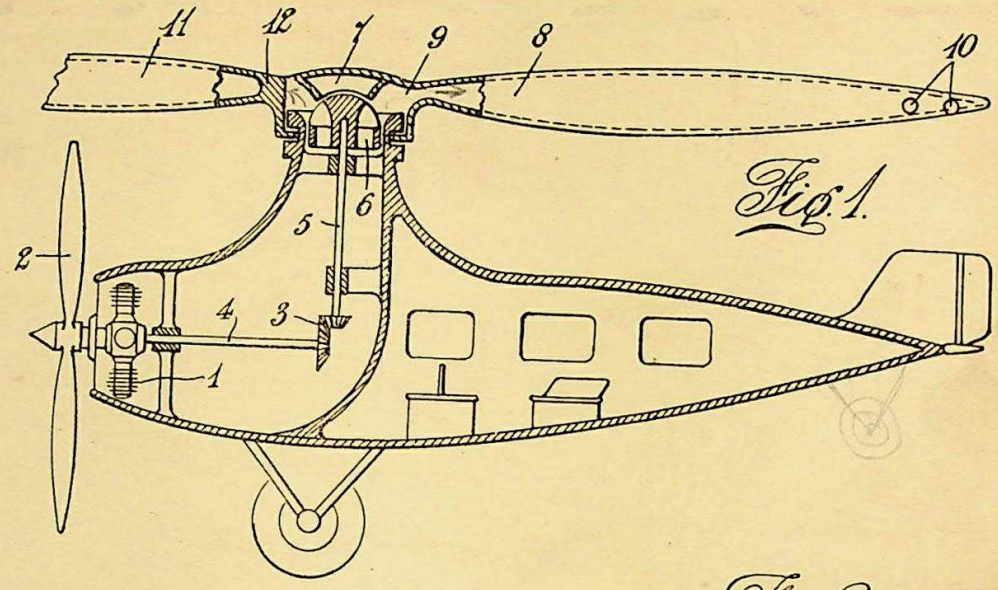

Fig. 1.

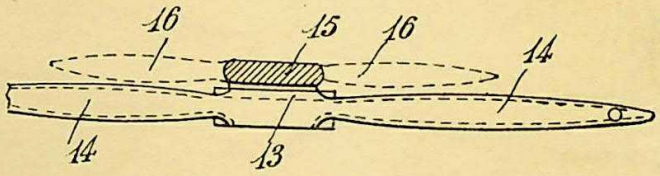

Fig. 2.

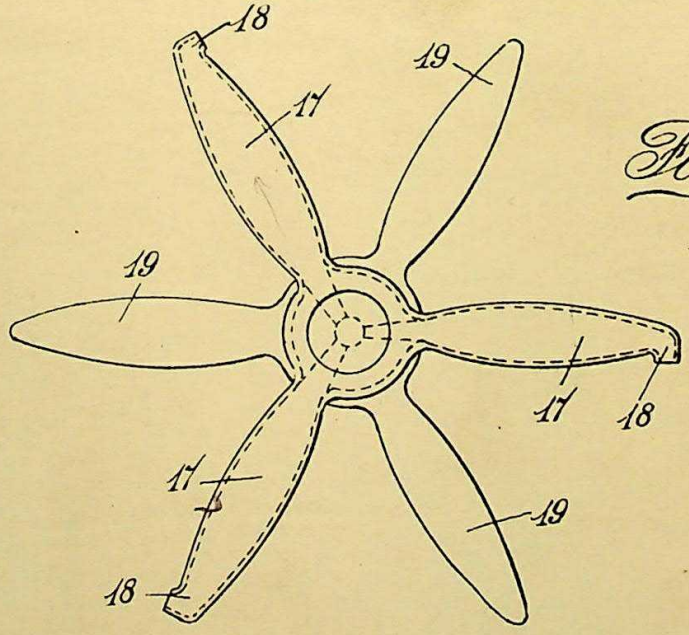

Fig. 3.

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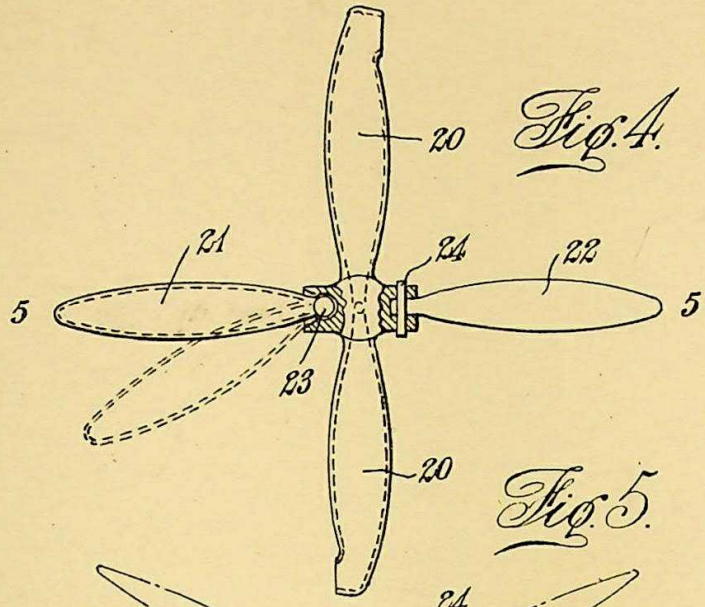
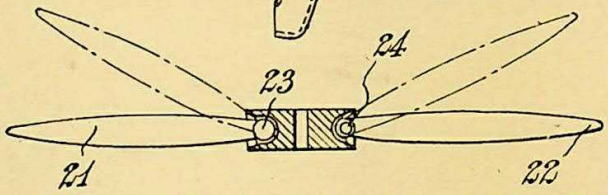


Fig. 4.

Fig. 5.



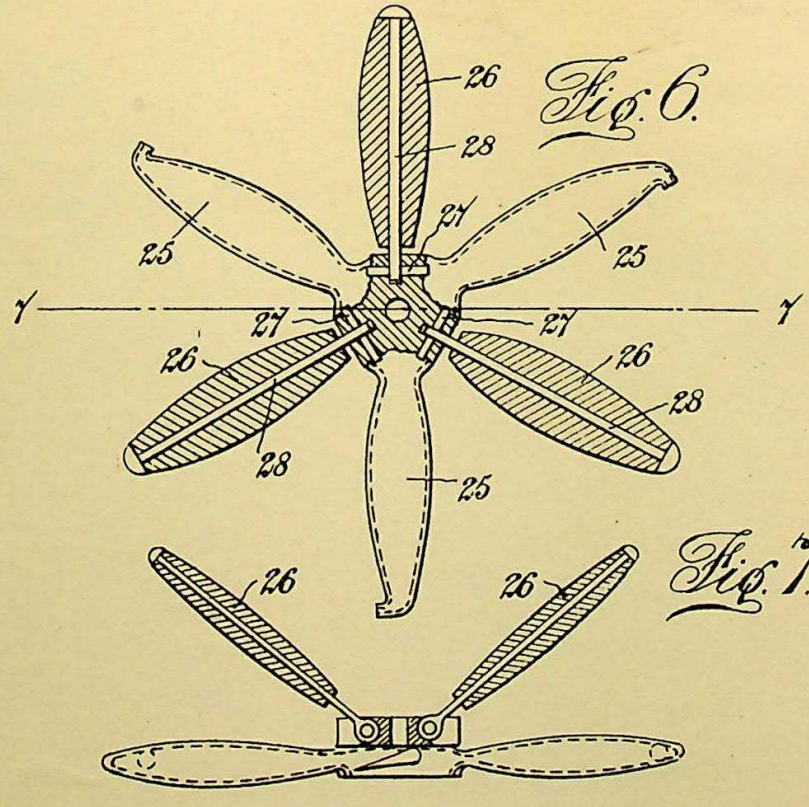


Fig. 6.

Fig. 7.

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PATENT SPECIFICATION

412,487

Convention Date (Germany): Jan. 26, 1933.

Application Date (in United Kingdom): Nov. 24, 1933. No. 32,942/33.

Complete Accepted: June 28, 1934.

COMPLETE SPECIFICATION.

Improvements in or relating to Aircraft of the Helicopter Type.

I, Dr. Ing. CLAUDE DORNIER, a German Citizen, of Friedrichshafen on Lake Constance, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to aircraft of the helicopter type which are provided with a rotatable arrangement of wings or blades.

According to the present invention an aircraft of the type aforesaid having wings or blades rotatable about a common axis is provided wherein a number of the wings or blades are driven on the reaction principle the remaining wings or blades being rotated by the reactively driven wings or blades. A number of the wings or blades are provided with channels and outlets which are required for the reaction drive further wings or blades being also provided which do not act on the reaction principle but are engaged or rotated by the former wings or blades. It is also possible according to the invention to replace one rotatable arrangement of driving and non driving wings or blades by several arrangements of wings or blades one or more than one arrangement comprising according to the invention driving wings or blades and non driving wings or blades or all driving wings or blades and the remaining arrangements comprising non driving wings or blades.

It is known per se to provide helicopters with rotatable wings or blades which are rotated on the reaction principle when the aircraft starts. The present invention assumes that a current of air flows through the driving wings or blades the said current of air being produced or caused by the flight of the aircraft and flowing through the wings or blades during flight. The current of air emerges from the wings or blades through outlets therein which are provided near the free ends of the wings or blades. The latter are designed for this method of driving and as calculations show the thickness of their profile must be considerably increased over and above the thickness required for wings or blades which are not driven on the reaction principle. It is not always necessary that all the wings or blades of a rotatable arrangement of wings or blades should be provided as driving wings or blades. It is possible therefore according to the present invention to use a rotatable arrangement of non driving and driving wings or blades as one unit or rotatable arrangements of non driving and/or driving wings or blades as separate but interconnected units. Further according to the present invention a number of the wings or blades may be made of a thinner section or profile thus saving weight and also reducing air resistance to the wings or blades when in rotation. An appreciable increase in efficiency is also obtained due to a decrease of the friction and other air current losses in the interior of the wings or blades. The present invention may be carried into effect in various ways. The most convenient method is to dispose both kinds of wings or blades in the same plane. Where desirable however the individual wings or blades may be joined or connected to a common hub and this arrangement of both types or wings or blades may be easily effected. If however the design and construction of the rotatable arrangement of wings or blades is such that it resembles an air propeller the blades of which are integral with the hub then it is advisable and more advantageous to provide two rotatable arrangements of wings or blades forming two units one unit comprising a hub with wings or blades secured thereto the said wings or blades being provided with ducts or channels and outlets therefrom and another hub having wings or blades connected thereto which however are not designed to act as reaction driving wings or blades this latter unit being superimposed on the other unit and consequently lying in a different plane. In such an arrangement the wings or blades which act as driving blades may vary as regards pitch, diameter and number from the other blades but one or more than one feature which characterises the said wings or blades may be common to both types

[*Price* 1/-]

of wings or blades. The idea of connecting the wings or blades of air propellers in an articulated manner to their hubs in order that they can be revolved round their axes or out of their plane of rotation or out of their radial position is well known. This variation of position may be effected automatically. As a rule however such variation in position is effected by means of a controlling device operable at will and serving in the case of lifting screws or helicopters either for the purpose of varying the lifting power of the whole propeller or of varying the effect of each propeller blade periodically during each revolution. The last mentioned possibility ensures with lifting screws or helicopters that the propeller which in the present invention is the rotating wing or blade arrangement when in rotation may be utilised to stabilise the aircraft. Each wing or blade may be connected to its hub by means of a ball and socket joint or by means of a ball bearing which will allow of free movement in all directions. It is also possible to pivotally mount one or more than one wing on a horizontal axis and also to mount the same wing so that it can rotate on its own axis which may be formed by a spindle pivotally mounted on the aforesaid pivot pin.

In order that the invention may be clearly understood and readily carried into effect reference is made to the accompanying drawings which show diagrammatically and by way of example constructions of helicopter aircraft in accordance with the present invention.

Figure 1 is a sectional elevation of an aeroplane provided with wings or blades which are shown partly in section in accordance with the present invention.

Figure 2 is an elevation partly in section of a modified arrangement of wings or blades also in accordance with the present invention. In this arrangement two sets of wings or blades are shown one set being superimposed on a lower set the two sets being disposed in different planes.

Figure 3 is a plan view for a helicopter type of aircraft showing six wings or blades rigidly connected together the construction thereof being hereinafter described.

Figure 4 is a plan of a four bladed arrangement of helicopter rotor comprising driving wings or blades and non driving wings or blades in accordance with the present invention.

Figure 5 is a section on the line 5—5 of Figure 4.

Figure 6 is a plan partly in section of a helicopter rotor comprising driving wings rigidly connected to a hub and non driving wings the latter being connected with the hub by means of a cardan joint.

Figure 7 is a cross sectional elevation on the line 7—7 of Figure 6.

Referring to Figure 1 a tractor motor is shown at 1 which drives a tractor screw propeller 2. The motor 1 is also arranged to drive a fan 6 through bevel wheels 3 and shafts 4 and 5, the fan 6 protruding into a rotor hub 7 provided with internal guiding devices. 8 are propeller wings or blades a certain number of which are designed as hollow blades and the latter are in communication with the interior of the rotor hub as at 9. Orifices 10 are provided near the tips of the hollow propeller blades 8. The fan 6 aspires the air from the nose of the fuselage and forces it into the hollow blades 8 from which the air issues through the orifices 10. The rotor is further provided with a number of blades which are solid or which may, as shown in the drawing also be designed hollow but are in every case closed off as at 12 from the air channels 9 in the hub.

In Figure 2 which shows a constructional form in which in contradistinction to the form shown in Figure 1 the two types of wings or blades lie in different planes whereas in Figure 1 the wings or blades all lie in the same plane. A hub or boss 13 serves together with wings or blades 14 as a reaction type drive. A hub 15 is rigidly connected with the hub 13, and is provided with blades 16 shown in the drawing in dotted lines, the latter blades do not exert any driving action.

In Figure 3 which shows a plan of a rotor of an aircraft according to the present invention, the rotor has six wings or blades which are rigidly connected together, the wings or blades indicated at 17 being provided with reaction nozzles at 18 and serving as drivers, whereas the wings or blades denoted by 19 have no air channels and are not connected to any such channels.

In Figure 4 a four wing or bladed arrangement is shown comprising driving wings or blades 20 and non driving wings or blades 21 and 22. The blade or wing 21 is connected with a hub by means of a ball and socket joint 23. The blade or wing 21 is thus free to turn around its longitudinal axis and is also free to be moved out of its plane of rotation and out of its radial position. The blade or wing 22 is connected to its hub by means of a bolt 24 disposed tangentially to the direction of rotation, that is to say the said wing 22 can only be moved out of its plane of rotation (Figures 4 and 5).

In Figure 6 a rotor is shown comprising driving wings 25 rigidly connected to

their hub and non driving wings 26 these wings or blades 26 are connected with the hub by means of a cardan joint. They are adapted so that they can be moved around bolts 27 out of their plane of rotation, and are also adapted to be revolved around the axes 28 (Figures 6. and 7). Movement out of the radial position is not intended.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An aircraft of the helicopter type having wings or blades rotatable about a common axis, wherein a number of the wings or blades are driven on the reaction principle the remaining wings or blades being rotated by the reactively driven wings or blades.

2. An aircraft according to claim 1, wherein all the wings or blades lie in one and the same plane.

3. An aircraft according to claim 1, wherein the wings or blades driven by reaction lie in a different plane from that of the wings or blades which are rotated by the reactively driven wings or blades.

4. An aircraft according to claim 1, wherein the wings or blades which are not driven by reaction are connected to their hub in an articulated manner, in order that they can be temporarily revolved around their longitudinal axes and/or out of their plane of rotation and/or out of their radial position, whereas the reactively driven wings or blades are rigidly connected to their hub.

5. An aircraft according to claim 1, wherein the reactively driven wings or blades differ in respect of pitch, surface, cross section and in number from the other wings.

6. An aircraft according to claim 5, wherein one or more than one feature of the characteristic features of the wings or blades is common to both set of wings or blades.

7. An aircraft having reactively and non reactively driven wings or blades substantially as hereinbefore described in connection with the accompanying drawings.

Dated this 24th day of November, 1933.

J. S. WITHERS & SPOONER,
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Agents for the Applicant.

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